REMARKS

Prior to entry of this amendment, claims 1-50 were pending, with claims 19-40 and 46-50 being withdrawn from consideration. This amendment cancels claims 22-29 and adds new claims 51-62. The requested amendments to the claims do not add any new matter.

The undersigned and Stephen B. Barone of Greenlee, Winner and Sullivan thank the Examiner for the courtesy of a telephone interview on October 30, 2008. In this interview, proposed amendments to claims 1, 41, and 42 and cited references U.S. Patent No. 4,346,142 (Sammells) and WO 01/96847 (Zhou) were discussed. The 35 USC 112 Rejection and the restriction requirement of the Office Action of June 4, 2008 were also discussed.

The Restriction Requirement

The Office Action of June 4, 2008 asserts that claims 30-39 and 46-50 are directed to an invention that is independent or distinct from the invention originally claimed. Applicants note that original claim 1 refers to a nanostructured material of formula $Si_{(1-z)}Ge_z$ or a alkali metal alloy thereof wherein $0<z\leq1$. When z is one, the nanostructured material is germanium. Therefore, Applicants submit that nanostructured material comprising germanium or a germanium alkali metal alloy falls within the scope of the originally presented invention and respectfully request that claims directed to nanostructured material comprising germanium or a germanium alkali metal alloy remain under consideration. To clarify this issue, claims 41 and 42 have been amended to use the formula of original claim 1 to describe the composition of the nanostructured film material.

The Amendments to the Claims

Claim 1 has been amended to specify that in the formula $Si_{(1-z)}Ge_z$, z is from 0.25 to 0.75. This amendment is believed to be supported by Example 9 of the specification as filed (paragraphs 91-92 and Figure 12).

Please cancel claims 22-29 without prejudice.

Amended claim 41 now specifies that the electrode comprises a nanofilm of nanostructured material of formula $Si_{(1-z)}Ge_z$ wherein $0 < z \leq 1$. The claim also specifies that the nanofilm is continuous and is not in the form of an aggregate of nanoparticles. The limitation that the film is not formed of aggregated nanoparticles distinguishes the structure of the nanofilm from the nanoparticle aggregate films described at paragraphs 69 and 72 of the specification. Support for this limitation is found in Example 4 (paragraph 73) and the bright field transmission (TEM) image of Figure 5A. The attached Declaration of Jason Graetz under 37 CFR 1.132 provides evidence that this bright-field TEM image does not show a film of aggregated nanoparticles of any shape. Claim 41 is further supported by original claims 1 and 7, and paragraphs 57, 59, and 71 of the specification as filed.

Amended claim 42 now specifies that the electrode comprises an alkali metal alloy of a nanofilm of nanostructured material of formula $Si_{(1-z)}Ge_z$ wherein $0 < z \leq 1$. The claim also specifies that the nanofilm is not in the form of an aggregate of nanoparticles and is continuous prior to electrochemical alloying with the alkali metal. Claim 42 is supported by original claims 1 and 7, and paragraphs 14, 59, 71 and 73. Applicants note that the limitation that the alkali metal alloy is produced by electrochemically alloying an alkali metal with the nanostructured framework material is supported by paragraph 14 (lines 1-3) of the specification as filed. Although the initial state of the as synthesized film is continuous, electrochemical alloying of the film may produce some cracking of the film, as noted at paragraph 84 of the specification as filed.

New claim 51 depends from claim 1 and specifies that in the formula $Si_{(1-z)}Ge_z$, z is greater than 0.5. This limitation is believed to be supported by paragraph 46 of the specification as filed.

New claim 52 depends from claim 41 and specifies that the nanofilm adheres to a substrate which serves as a current collector. This limitation is supported at page 15, paragraphs 59 and 60.

New claim 53 depends from claim 41 and specifies that the electrode comprises alternating layers of a nanofilm of nanostructured material of formula $Si_{(1-z)}Ge_z$ and of a metal film. This limitation is supported at page16, paragraphs 61 and 62.

New claim 54 depends from claim 41 and specifies that the thickness of the nanofilm is no greater than 500 nm. This limitation is supported at page 13, paragraph 57.

New claim 55 depends from claim 41 and specifies that the nanofilm is amorphous. This limitation is supported at page 14, paragraph 57.

New claim 56 depends from claim 41 and specifies that the nanofilm is a Ge-Si alloy. This limitation is believed to be supported by paragraphs 46 and 47 of the specification as filed.

New claim 57 depends from claim 42 and specifies that the nanofilm adheres to a substrate which serves as a current collector. This limitation is supported at page 15, paragraphs 59 and 60.

New claim 58 depends from claim 42 and specifies that the electrode comprises alternating layers of an alkali metal alloy of a nanofilm of nanostructured material of formula $Si_{(1-z)}Ge_z$ and of a metal film. This limitation is supported at page 16, paragraphs 61 and 62 and 14.

New claim 59 depends from claim 42 and specifies that the alkali metal is lithium. This limitation is supported by original claim 2.

New claim 60 depends from claim 42 and specifies that the thickness of the nanofilm is no greater than 500 nm. This limitation is supported at page 13, paragraph 57.

New claim 61 depends from claim 42 and specifies that the nanofilm is amorphous prior to electrical alloying. Claim 56 is supported at page 14, paragraph 57 and at page 20, paragraph 77, which describes formation of Li-Ge crystalline phases.

New claim 62 depends from claim 42 and specifies that the nanofilm is a Ge-Si alloy. This limitation is believed to be supported by paragraphs 46 and 47 of the specification as filed.

It is believed that no new matter has been added by any of the amendments requested with this response.

The Amendments to the Drawings

Formalized replacement drawing sheets for Figures 4A, 4B, 5A and 5B are provided to improve the clarity of the images. The images have been enlarged, but no new matter has been added.

The Rejection under 35 U.S.C. 112

Claim 42 was rejected under 35 U.S.C. 112, first paragraph. The rejection is believed to be obviated by the present amendments to claim 42 and the additional information provided regarding support for claim 42. Reconsideration and withdrawal of the rejection is respectfully requested.

The Rejections under 35 U.S.C. 103(a)

Sammells in view of Zhou

Claims 1-7, 11-18, 41 and 42 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,346,142 hereinafter Sammells in view of WO 01/96847, hereinafter referred to as Zhou.

Amended claim 1 relates to electrodes which comprise nanostructured silicon-germanium alloy materials or alkali metal alloys thereof. The silicon-germanium materials have the formula $Si_{(1-z)}Ge_z$, where z is from 0.25 to 0.75.

Sammells reports ternary lithium-germanium-silicon alloys. As acknowledged in the Office Action of June 4, 2008, these alloys are not nanostructured. Sammells states that suitable binary germanium-silicon alloys contain about 1 to about 10 mole percent germanium; preferably the alloy contains about 2 to about 5 mole percent germanium (Col. 4, lines 43-46). Sammells describes suitable lithium-germanium silicon alloys as having the formula $Li_aGe_bSi_c$ wherein a is a number greater than zero up to 4.4, b is a number about 0.02 to about 0.05 and c is 1 (Col. 4, lines 46-49). Sammells therefore does not teach or suggest germanium-silicon alloys containing at least 25 percent germanium for use as electrodes, since this amount of germanium is at least 2.5 times the maximum amount specified by Sammells. Sammells does not teach use of an amorphous silicon-germanium alloy material or describe any benefit to the use of amorphous materials as compared to crystalline or polycrystalline materials.

Zhou teaches use of nanostructures formed of silicon, germanium, aluminum, silicon oxide, and germanium oxide (page 4). Nanostructure shapes described include cage-like spherical particles or rod/wire shaped objects (page 5). Applicants note that Zhou does not appear to describe silicon-germanium alloy nanostructures. Therefore, Zhou does not teach germanium-silicon alloys containing 25-75 mole percent germanium. Zhou describes formation of a film of purified nanostructure material by solution deposition to form a coating (page 6).

This deposition method will produce a film of which is an assembly or aggregate of Zhou's nanostructures. Zhou also does not appear to teach use of amorphous silicon, germanium, or silicon-germanium alloy materials (The powder x-ray diffraction pattern of Figure 2 of the reference shows peaks identified as Si(111) and Si(220), corresponding to peaks for crystalline material). Zhou also does not describe any benefit to the use of amorphous materials as compared to crystalline or polycrystalline materials.

Neither the Sammells nor the Zhou references teach the limitation of amended claim 1 that the germanium-silicon alloy contains 25-75 mole percent germanium. The combination of references also fails to teach this limitation, especially since Sammells recommends use of significantly lower germanium content in Ge-Si alloys. Therefore, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 1. Claims 2-7 and 11-18 depend from and incorporate all the limitations of claim 1. Therefore, Applicants also request reconsideration and withdrawal of the rejections of claims 2-7 and 11-18.

Amended claim 41 specifies that the nanofilm is a continuous film which is not in the form of an aggregate of nanoparticles. The attached Declaration of Jason Graetz under 37 CFR 1.132 provides evidence to clarify that in an exemplified embodiment of the invention the contiguous nanofilm is not formed of aggregated nanoparticles of any shape. Therefore, the films of claim 41 have a different structure than the Zhou's aggregated nanostructure films and the Zhou reference does not teach the film structure of claim 41. The Sammells reference fails to cure this deficiency.

The structure of the film can influence the performance of the electrode. The inventors of the present application have found that the structure of the continuous Ge thin films of Examples 2 and 4 can provide enhanced electrode capacity stability as compared to the Ge nanocrystal aggregates of Examples 1 and 3. Figure 9 of the application shows that the evaporated germanium

nanofilm retains greater capacity with increasing number of cycles than the layer of germanium nanocrystals.

In view of all the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 41.

Claim 42 specifies that the electrode comprises an alkali metal alloy of a nanofilm, the nanofilm not being formed of aggregated nanoparticles. As discussed above, Zhou reference teaches an aggregated nanostructure film structure. Therefore, the Zhou reference does not teach film structure of claim 42 and the Sammells reference fails to cure this deficiency. Applicants therefore respectfully request reconsideration and withdrawal of the rejection of claim 42.

Sammells in view of Zhou and further in view of Kriesel

Claims 8-10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou as applied to claim 1 above and further in view of U.S. Pre-Grant Publication No. 2004/0106741, hereinafter referred to as Kriesel.

Kriesel describes thin layer compositions which are nanofilms prepared from various macrocyclic module components and various polymeric and amphiphilic components (paragraph 2). Therefore, Kriesel's films differ in composition from the alloy nanofilms referred to in claims 8-10 (Ge-Si or Ge-Si-alkali metal alloys). Although Kriesel teaches methods suitable for the formation of films of various combinations of macrocyclic module, polymeric and amphiphilic components (e.g. paragraphs 110,119, 163, 218 and 219), Applicants respectfully submit that these methods are not generally suitable for formation of the metal or alloy nanofilms of the present invention.

Applicants submit that the combination of the Sammells, Zhou and Kriesel references does not teach or suggest the limitation that the germanium-silicon alloy contains 25-75 percent germanium, which appears in amended claim 1.

Since claims 8-10 depend from and incorporate all the limitations of amended claim 1, Applicants submit that the combination of the Sammells, Zhou and Kriesel references fails to teach all the limitations of claims 8-10. Applicants therefore request reconsideration and withdrawal of the rejections of claims 8-10.

Sammells in view of Zhou and further in view of Utsugi

Claims 43-45 were rejected under 35 U.S.C. 103(a) as being unpatentable over Sammells in view of Zhou as applied to claim 1 and further in view of WO 03/073535 (U.S. Pre-Grant Publication No. 20040258997 used as the English equivalent) hereinafter Utsugi.

Utsugi describes multilayer electrodes having a first layer largely composed of carbon and a second layer largely composed of filmy material having lithium ion conductivity. The second layer is formed of one or more kinds of particles selected from metal particles, alloy particles and metal oxide particles bound by a binder. (Col. 2, paragraph 14). Utsugi does not appear to describe particular alloy compositions. Therefore, Utsugi does not teach germanium-silicon alloys containing 25-75 mole percent gemanium.

Claims 43-45 depend from and incorporate all the limitations of amended claim 1, which includes the limitation that the germanium-silicon alloy contains 25-75 mole percent gemanium. The Sammells, Zhou or Utsugi references do contain this limitation either singly or in combination. Therefore, Applicants respectfully request reconsideration and withdrawal of the rejection.

The New Claims

New claim 51 depends from and incorporates all the limitations of claim 1. Since claim 1 is believed to be in condition for allowance, claim 1 is also believed to be in condition for allowance. Applicants note that the amount of germanium specified by claim 51 is at least 5 times the maximum amount specified by Sammells.

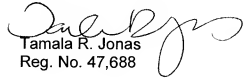
New claims 52-56 and 57-62 depend from and incorporate all the limitations of claims 41 and 42, respectively. Since claims 41 and 42 are believed to be in condition for allowance, claims 52 -55 and 56-60 are also believed to be patentable over the cited references. Furthermore, claims 55 and 61 contain the additional limitation that the nanofilm or the nanofilm prior to electrochemical alloying with the alkali metal is amorphous. As previously discussed, neither the Sammells nor the Zhou references teach or suggest the use of amorphous germanium or silicon-germanium alloys.

Summary

Applicants assert that all claims are in condition for allowance, and therefore, passage to issuance is respectfully requested.

Applicants hereby request that an extension of time be granted for the filing of this response. It is believed that a fee of $754, for the addition of four claims ($104), the payment of a two month extension of time ($245), and the concurrent RCE submission ($405) is due with this submission. We note that 12 new claims were added and that 8 claims were cancelled, for a net increase of four claims in the application. If the amount submitted during EFS filing of this response is incorrect, please charge any deficiency or credit any overpayment to deposit account 07-1969.

Respectfully submitted.



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